PATENT
1928-0153P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant:	HO, Seung Pun	Conf.:	
Appl. No.:	NEW	Group:	
Filed:	July 31, 2003	Examiner:	
For:	ELECTRIC MOTOR		

L E T T E R

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

July 31, 2003

Sir:

Under the provisions of 35 U.S.C. § 119 and 37 C.F.R. § 1.55(a), the applicant(s) hereby claim(s) the right of priority based on the following application(s):

Country	Application No.	Filed
GREAT BRITAIN	0218198.0	August 6, 2002

A certified copy of the above-noted application(s) is(are) attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By _____
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KM/tmr
1928-0153P

Attachment(s)

(Rev. 04/29/03)

HO et al
July 31/03
BSKB, LLP
703-205-8000
1928-0335
1 OF 1

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

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Dated 16 July 2003

Patents Form 1/77

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THE PATENT OFFICE
= 6 AUG 2002
NEWPORT

06AUG02 E736837-1/D02896
P01/7700 0.00-0218198.0

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
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1. Your reference

   MRH.P04709GB/P362GB

2. Patent application number
   (The Patent Office will fill in this part)

   06 AUG 2002 0218198.0

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

   Johnson Electric S.A.
   Rue Fritz-Courvoisier 40
   CH-2300 La Chaux-de-Fonds
   Switzerland

   04018313005
   Patents ADP number *(if you know it)*

   If the applicant is a corporate body, give the country/state of its incorporation

   Switzerland

4. Title of the invention

   Fan

5. Name of your agent *(if you have one)*

   Messrs Marks & Clerk

   "Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

   27 Imperial Square
   Cheltenham
   GL50 1RQ

   Patents ADP number *(if you know it)*

   570001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

   a) any applicant named in part 3 is not an inventor, or
   b) there is an inventor who is not named as an applicant, or
   c) any named applicant is a corporate body.
   See note (d))

   Yes

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	5
Claim(s)	1
Abstract	1
Drawing(s)	3 +3

10. If you are also filing any of the following, state how many against each item.

Priority documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. I/We request the grant of a patent on the basis of this application.

Signature Marks & Clerk Date Messrs Marks & Clerk 5th August 2002

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr M R Higgins
01242 524520

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Notes

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Fan

Background of the Invention

This invention relates to electric motors and in particular, to a miniature electric motor having an internal cooling fan.

Miniature electric motors with internal cooling fans are well known with the fan providing a source of cooling air flow through the motor so that the motor can run at a higher current rating or power than it could be otherwise.

In a miniature electric motor, and in particular, miniature PMDC motors with wound rotors, the fans are attached directly to the armature core as shown in GB 2189944 for example or they may be mounted directly onto the commutator about the terminals or tangs. Commutator mounted fans are made of more expensive thermoset plastic to withstand the high temperatures of the commutator which can be especially high under stall conditions when the rotor is locked resulting in no cooling air flow from the fan.

The armature core fans can be made of cheaper thermoplastic as it is not in direct contact with the commutator and thus, does not have to withstand such high temperatures.

In a PMDC motor with a wound rotor in which the rotor windings are connected to the commutator by way of Insulation Displacing Terminals (IDT) as shown for example, in GB 2128818, lead wires are strung across recesses in a crown into which the commutator segments and base or at least the terminals are inserted. The crown, however, provides a big impediment to cooling air flow across the commutator surface generated by a fan fixed to the rotor core due to the physical size and location of the crown.

Thus, there is a need for an internal cooling fan arrangement within a miniature electric motor having a commutator with insulation displacing terminals which has or can readily receive/support an internal cooling fan for the motor.

Summary of the Invention

Accordingly the present invention provides an electric motor having a wound rotor and a stator, the rotor having a rotor core mounted on a shaft, a commutator mounted on the shaft adjacent one end of the rotor core and rotor windings wound around the

rotor core and connected to terminals of the commutator, and a fan for generating a flow of cooling air, wherein the commutator has a base and a plurality of commutator segments fixed to the base, each segment having a brush contact portion a terminal and the base having a support portion supporting the brush contact portion of the segments and a crown supporting the terminals and wherein the fan has a plurality of fan blades extending radially from the crown.

Optional or desirable features may be found in the dependent claims.

Brief Description of the Drawings

Two preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side view of a motor according to a first embodiment of the present invention;

Figure 2 is an elevation view of a rotor of the motor of Figure 1 with an exploded fan;

Figure 3 is an end view of the rotor of Figure 2 with the fan fitted;

Figure 4 is a sectional view of a portion of the rotor of Figure 3;

Figure 5 is an enlarged sectional view of a part of Figure 4;

Figure 6 is an exploded pictorial view of the fan and a crown of the rotor of Figure 2; and

Figure 7 is an exploded pictorial view of a fan and crown according to a second embodiment.

Detailed Description of the Preferred Embodiments

Figure 1 shows, in side view, a small PMDC motor 10 representing the preferred embodiment of the invention. The motor has a deep drawn metal rear housing 11 supporting a permanent magnet stator. The open end of the housing is closed by an end cap 12 which supports motor terminals 13 and brushes. The housing 11 has ventilation apertures 19. A wound rotor or armature cooperates with the stator. The motor has a shaft 14 journalled in bearings fitted to the end cap 12 and closed end of the housing.

The rotor 15 is shown in Figure 2. The rotor 15 comprises rotor core 16 mounted on the shaft 14. A commutator 17 is mounted on the shaft 14 at one end of the core 16 adjacent the end cap 12 so that the brushes make sliding contact with the commutator 17. Windings 18 are wound around poles of the rotor core 16 and electrically terminated on the commutator 17. A fan 20 is fitted to the commutator 17.

As shown in Figure 2, the fan 20 is fitted to the commutator 17 after the rotor 15 has been wound. This allows the rotor to be wound and balanced without interference by the fan 20. The fan 20 is pressed onto the commutator 17, in particular on to the part which supports the commutator terminals 21, known as the crown 22, and is held in place by snap fit fingers 23.

An end view of the commutator 17 and fan 20 assembly is shown in Figure 3. Figure 4 is a cross-section of the assembly viewed along section line IV-IV of Figure 3 and Figure 5 shows in detail a simple snap fit finger arrangement s indicated by circle V in Figure 4.

The commutator 17 is a two part, mechanical connection or insulation displacing type commutator. The support is in two parts, a cylindrical sleeve 24 supporting the commutator segments 25 and the crown 22 which supports lead wires from the windings 18 as well as receiving the sleeve 24 and the terminals 21 of the commutator segments 25. The terminals 21 are insulation displacing terminals which have an axial slot forming two arms which straddle and grip respective lead wires to make electrical connection therewith as the two parts are pressed together.

An exploded perspective view of the fan 20 and the crown 22 in shown in Figure 6. The crown 22 has a plurality of housings 26 which receive the terminals and support the lead wires as the terminals are pressed into the housings 26 and onto the lead wires. The fan 20 is of the centrifugal type and has an inner annular ring or collar 27 from which fan blades 28 extend radially outwardly. The blades 28 are shown as flat blades designed for use in either direction of rotation.

The collar 27 is keyed to the crown 22 by projections 29 on the housing which engage slots 30 in the collar 27 of the fan. This stops the fan 20 rotating about the crown 22 and limits axial movement of the fan 20 towards the rotor core 16. Larger cut-outs in the collar 27 snugly accepts the housings giving additional rotational integrity. Resiliently deformable fingers 23 extend axially from the slots 30. The distal end of

the fingers has a tapered head 32 with a square shoulder 33. The shoulder 33 engages a corresponding abutment 34 on a small projection 35 on the housings 26 when the fan is pressed into position to prevent removal or axial movement of the fan 20 with regard to the commutator housing 26 in a direction away from the rotor core. The projection may have an axially outer surface which is tapered to assist the tapered head of the finger 23 to resiliently deflect the finger over the projection 35 during assembly. An enlarged detail view is shown in Figure 5.

The fan blades 28 are shown with a chamfer on their outer edge. This chamfer is to avoid components or structures within the motor, such as posts for holding the brushes or if on the other side, it may be to avoid the stator magnets.

Figure 7 is an exploded perspective view, similar to Figure 6, of an alternative embodiment. In this embodiment, the keying projection 29 is radially extended to form a fan blade, thus the fan 20 can have less fan blades. This design is useful for low to medium power applications where standard parts can be used and the fan added or not added on as the application requires, while still providing a small amount of cooling air flow when the fan 20 is not added.

Advantage of the Invention

The use of a snap fit fan attached to the commutator allows the rotor to be completely wound and balanced and the commutator to be dressed before the fan is added to the rotor. Although this is usual, the snap fit fan, being a moulded part can be balanced by design and requires no other parts to fix the fan to the commutator which may otherwise affect the balance of the rotor. Prior art fans which were pressed onto the rotor core winding slots still required glue to ensure reliable attachment. The glue is a source of unbalance as its location and volume varies with each application. GB 2189944 also disclosed a snap fit fan but this requires a separate mounting plate to be fixed to the rotor core before the rotor is wound. This is an additional part and it does complicate the winding procedures.

The embodiments described above are given by way of example only and various modifications will be apparent to persons skilled in the art without departing from the scope of the invention as defined in the appended claims.

While a cylindrical mechanical connection type commutator with a two part base has been used to demonstrate the invention, application of the invention is not so limited

and can be applied to commutators with a one part base and with any type of contact material including copper, silver and carbon.

The cooling fan is directly mounted on a radially outer portion of the commutator base which supports the commutator terminals. The mounting is mechanical without the use of adhesive or glue. The assembly process is simple, reliable and robust.

Claims

1. An electric motor having a wound rotor and a stator,

the rotor having a rotor core mounted on a shaft, a commutator mounted on the shaft adjacent one end of the rotor core and rotor windings wound around the rotor core and connected to terminals of the commutator, and a fan for generating a flow of cooling air,

wherein the commutator has a base and a plurality of commutator segments fixed to the base, each segment having a brush contact portion and a terminal and the base having a support portion supporting the brush contact portion of the segments and a crown supporting the terminals and wherein the fan has a plurality of fan blades extending radially from the crown.

2. A motor according to claim 1, wherein the fan has an integral inner collar from which the fan blades extend.

3. A motor according to claim 2, wherein the collar engages the crown and is held thereto by complementary formations including snap-fit detents.

4. A motor according to claim 3, wherein the complementary formations further include blade like projections extending radially from the crown which engage slots in the collar to prevent circumferential movement of the collar about the crown.

5. A motor according to claim 3, wherein the snap-fit detents include at least one projection formed on each housing.

6. A motor according to any one of the preceding claims, wherein the terminals of the commutator segments are insulation displacing type terminals and the crown has a plurality of housings in which the terminals and lead wires of the rotor windings are received.

7. A motor according to any one of the preceding claims, wherein the commutator is a cylindrical type commutator.

8. An electric motor, substantially as hereinbefore described with reference to the accompanying drawings.

Abstract

A miniature PMDC motor has a wound rotor 15 comprising a rotor core 16 and a commutator 17 mounted on a shaft 14. A cooling fan 20 is directly mounted onto the commutator 17 by use of a mechanical snap-fit type connection. Projections 29 on the commutator mate with recesses in the fan 20 to prevent relative rotational movement and detents including resilient fingers 23 and projection surfaces 34 hold the fan axially.

Fig. 2

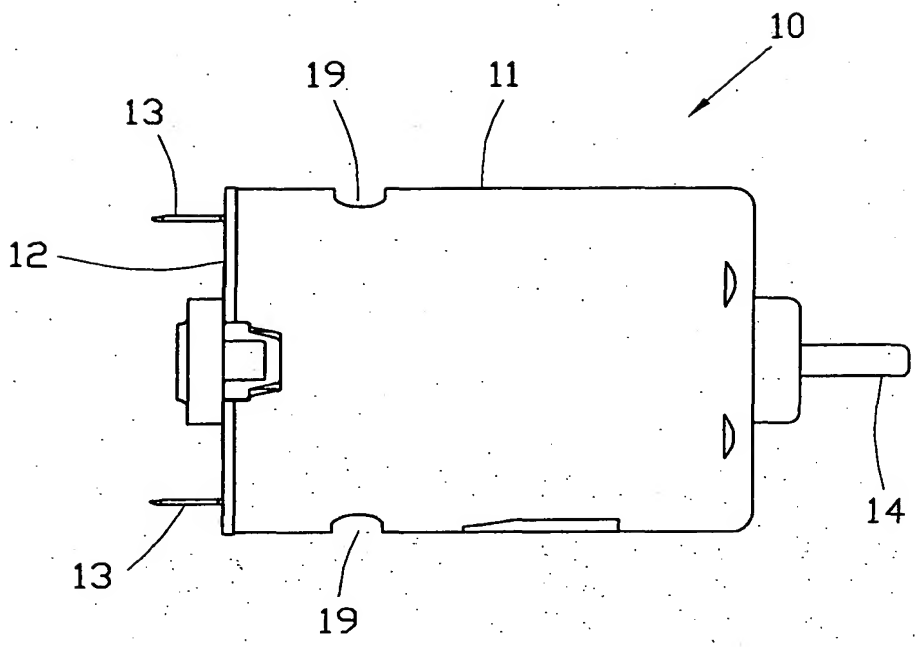

FIG. 1

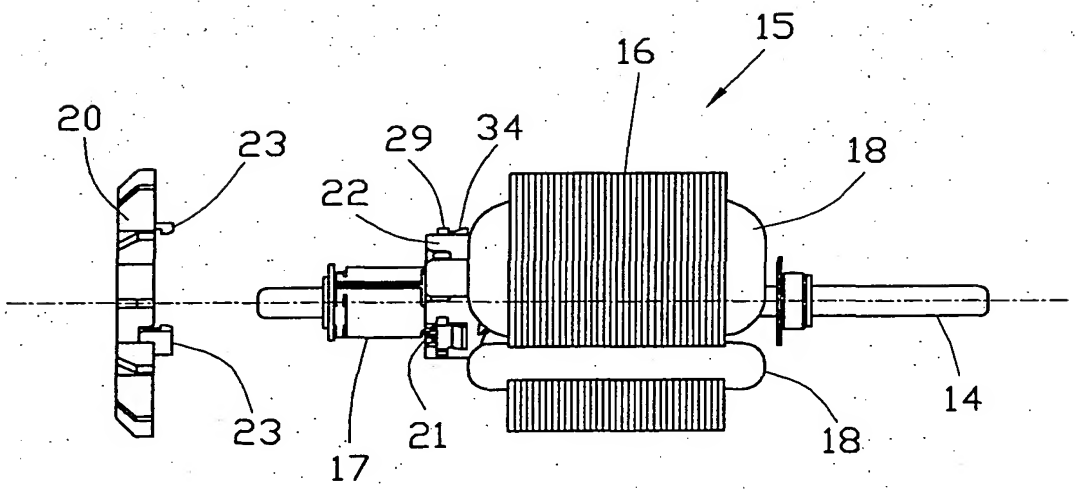

FIG. 2

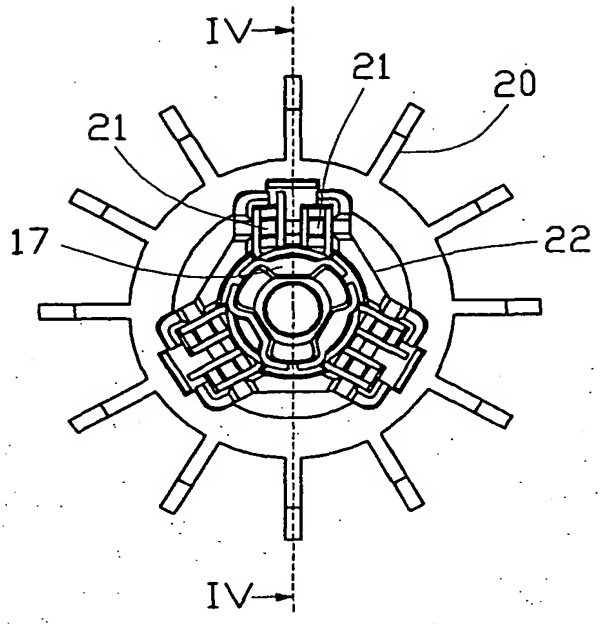

FIG. 3

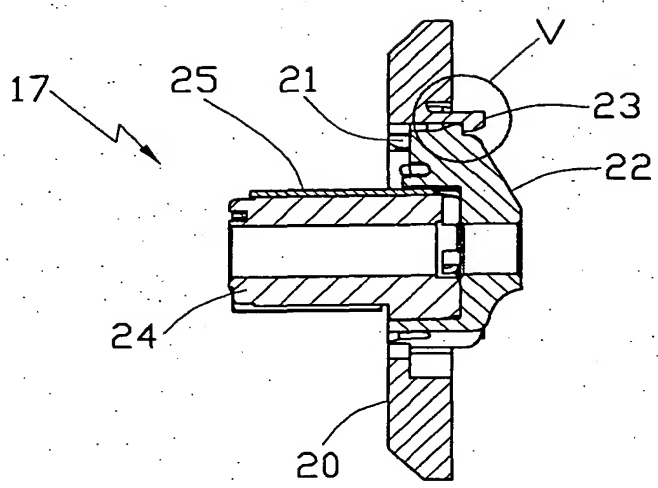

FIG. 4

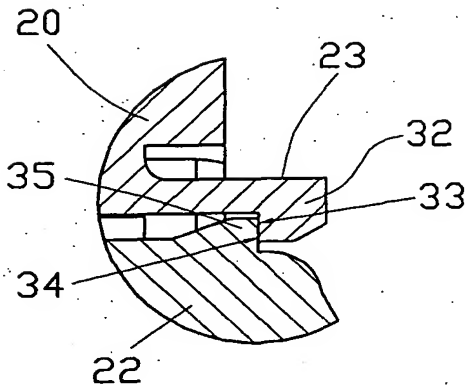

FIG. 5

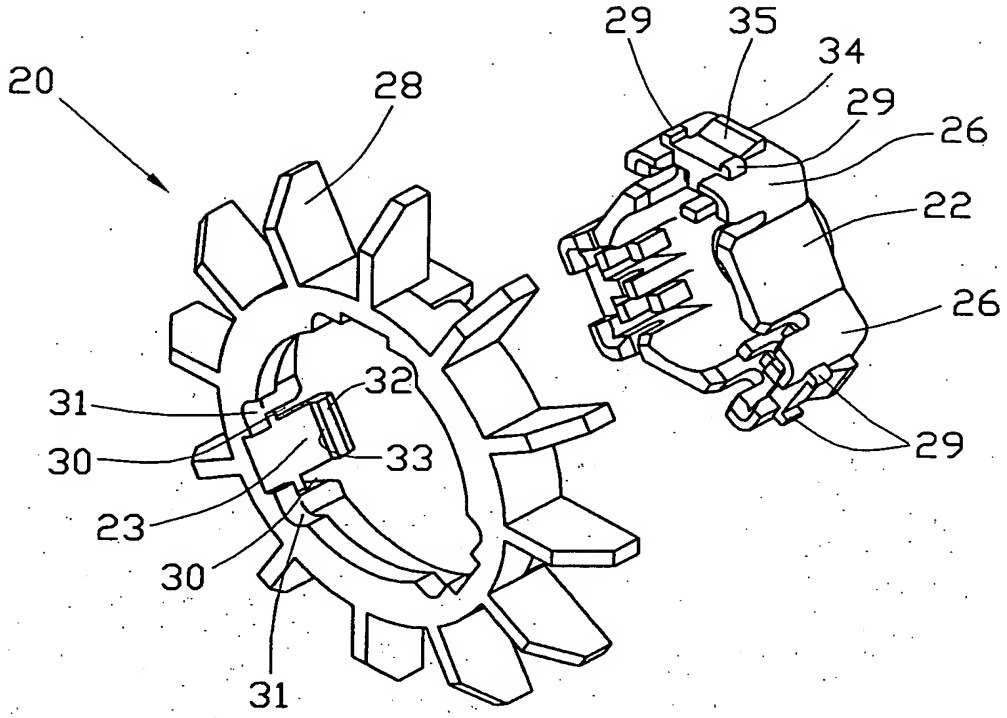
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FIG. 6

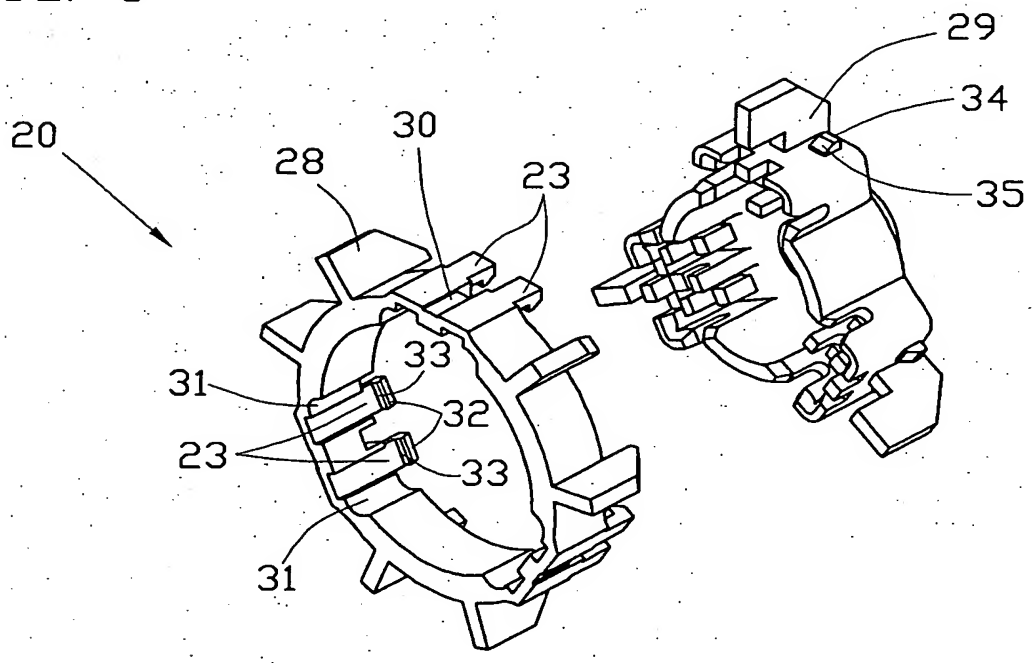
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FIG. 7